Preparing for Sea Level Rise: Development of an Adaptation Strategy for the State of Delaware

Issue Characterization Workshop

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Summary Document

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Introduction

Delaware's coast has played a significant role in the history, culture, and economy of the state. No part of the state is more than 8 miles from tidal waters and the state's geography is predominantly low-lying coastal plains. As a result, Delaware is highly susceptible to rising sea levels.

Any acceleration of sea level rise in Delaware may have significant impacts for our coastal communities. Potential impacts include: inundation of low lying coastal areas; increased extent and severity of flooding during storm events; increased coastal erosion during storm events; saltwater intrusion into groundwater supplies; and increased salinity in rivers and streams. Secondary impacts may include loss of recreational and economic resources; changes to habitat; and operation problems for wells, septic systems and sewage treatment facilities.

A Sea Level Rise Adaptation Plan is being developed to better evaluate and, when necessary, address these impacts. This statewide plan will include an analysis of the issues affecting Delaware and will provide recommendations to ensure that Delaware pro-actively plans for these effects. To initiate the development of this plan, a workshop was held to engage a focused group of likely sea level rise adaptation stakeholders in an issue identification process.

This document summarizes the results of the one-day workshop "Preparing for Sea Level Rise: Development of an Adaptation Strategy" held on March 12, 2009. It contains a description of the process used, summaries of breakout group discussions and full text of 46 Issue Characterization Worksheets completed by workshop participants.

This workshop represented the first time a focus group of stakeholders came together to discuss potential impacts of sea level rise statewide. Results from this workshop will be used as the basis for the formation of a coordination committee, technical working groups and research and monitoring projects. Many more opportunities for stakeholder engagement will be provided during the development of the Sea Level Rise Adaptation Plan.

Background

A wide array of scientific research and information indicates that there are many likely impacts of changing global climate, one of which is sea level rise. For centuries, sea level rise has affected and will continue to affect all coastal regions of the United States.

Increasing sea levels are caused by "thermal expansion" and the melting of polar ice caps. As temperatures rise, water occupies more space; this is known as thermal expansion. In addition to the volume of the ocean increasing, land in the Mid-Atlantic is actually sinking as a result of geologic changes. This is known as "subsidence." Thermal expansion, melting of the polar ice caps and subsidence all combine to contribute to relative sea level rise.

Observations in the history of the Earth's climate, geography, geology and evolution have lead to theories that sea level has been highly variable over time. Approximately 130,000 years ago when global temperatures were much higher than present average, global sea level was about 5 meters higher than it is today. About 20,000 years ago, global temperatures were apparently much lower than present. At this time sea level was about 120 meters lower than present. Particularly along the Atlantic (e.g. Delaware Coast) and Gulf coasts, regional and local

subsidences are likely contributors to the sea level rise phenomenon.

A historic rate of sea level rise in Lewes, Delaware has shown a 1.05 foot rise between the years 1919 and 2006. The mean sea level trend is 3.20 millimeters per year. Other gauges in the region have show similar rates of sea level rise; 3.44 millimeters per year in Annapolis, Maryland and 3.90 millimeters per year in Sandy Hook, New Jersey. This rate is expected to increase due to climate change and accompanying melting of the Greenland and West Antarctic ice sheets.

To address issues pertaining to climate change, several committees have been convened within the past 2 decades, to study the causes and effects of climate change and sea level rise and to study potential adaptation and mitigation measures. The Intergovernmental Panel on Climate Change (IPCC) is a scientific intergovernmental organization that was established for the purpose of providing decision-makers and other interested parties with an objective source of information about climate change. The IPCC aims to assess scientific information obtained from experts from all regions of the world and their relevant disciplines. The IPCC has the ability to provide scientific technical and socio-economic information on climate change, along with options for adaptation and mitigation, in a policy-relevant yet policy neutral way to decision makers. Similarly, Climate Change Science Program (CCSP), sponsored by thirteen federal agencies in the U.S., integrates federal research on climate and global change.

In 2007, the IPCC projected that global sea level will likely rise between 19 and 59 centimeters (7 and 23 inches) by the end of the century. Recent research that is taking into account the rapid melting of Antarctic ice sheets put these numbers notably higher. An assessment report conducted by the U.S. Geological Survey (2009) estimates sea level rise with these melting ice sheets at 50 – 140 centimeters (1.64 – 4.59 feet) by 2100.

The above IPCC projection is also reported in the most recent CCSP report on global climate change: Synthesis and Assessment Product 4.1, Coastal Sensitivity to Sea Level Rise: A Focus on the Mid-Atlantic Region. The lead agency on this product was the U.S. Environmental Protection Agency (EPA), while other key participating agencies include U.S. Geological Survey (USGS) and National Oceanic and Atmospheric Administration (NOAA). This assessment report was based on three relative sea level rise scenarios using the twentieth century rate as the basis of these scenarios. These scenarios are: Scenario 1 – the twentieth century rate, which is generally 3 to 4 millimeters per year in the mid-Atlantic region (30 to 40 centimeters total by the year 2100); Scenario 2 – the twentieth century rate plus 2 millimeters per year acceleration (up to 50 centimeters total by 2100); Scenario 3 – the twentieth century rate plus 7 millimeters per year acceleration (up to 100 centimeters by 2100).

With the large amount of available scientific data, emerging technology and modeling capabilities of the scientific technical experts, there is no better time than now to start assessment of potential vulnerability to sea level rise and preparation for these effects in the long term.

Purpose of Workshop

The goal of this workshop was to the raise the awareness regarding potential sea level rise impacts in Delaware and to initiate dialogue about sea level rise with an initial group of stakeholders. The workshop was also designed to develop a list of sea level rise issues of concern and to have participants develop an initial set of issue descriptions in a standard written format. These issue

identifications and descriptions provide a foundation for determining the priority issues for the sea level rise adaptation strategy.

The Adaptation Plan Process

Developing a statewide strategy for adapting to sea level rise involves a comprehensive process for identifying environmental and socio-economic problems, compiling sound scientific data, identifying data gaps associated with these problems, developing management strategies, and crafting action plans to resolve these problems and implement the necessary strategies. This requires input and involvement from multiple stakeholders: local and regional experts; local, state, and federal government agencies; businesses; nonprofit organizations; and members of the public. It is critical that the adaptation strategy uses the best and most current data and information resources available to resolve issues that pertain to sea level rise, as well as developing an effective plan that will be implemented through collaboration with stakeholders.

This collaborative process will be carried out in four phases: Issue characterization; issue prioritization; strategy development; and implementation. This workshop is the initial part of the Issue Identification phase.

Issue Characterization. This process entails identifying data needs and reviewing existing research. Directed communication on the topic of sea level rise in the state will be stimulated amongst a wide array of decision-makers and experts. New information on the issues, modifications and refinements will be incorporated into the strategy development process based on the best available science and technology. In addition, the Delaware Experimental Program to Stimulate Competitive Research (EPSCoR) has committed to support research that will help address information needs for characterizing sea level rise impacts in Delaware.

Issue Prioritization. To ensure a pragmatic and effective approach to sea level rise, it is necessary to prioritize these issues and focus our efforts on developing strategies for the most important issues. Technical and policy experts will review the data and make any necessary adjustments. The prioritized issues will then provide the information necessary to begin the strategy development process.

Strategy Development. Stakeholders will identify possible "solutions" to the prioritized issues. Workshops and small focus groups will be held for this purpose. These strategies will provide an action plan for sea level rise adaptation.

Implementation. A long term mechanism for ensuring the implementation of the adaptation plan will be identified. Strategies included in the adaptation plan will be prioritized and initiated. Evaluation of the efficiency of implemented strategies is a critical part of this process as it provides a basis for discontinuing ineffective strategies and developing new strategies to meet new needs.

For more information on the adaptation plan please visit the website: http://www.swc.dnrec.delaware.gov/coastal/Pages/SeaLevelRiseAdaptation.aspx

The Workshop Process

To efficiently develop management strategies, it is extremely important that stakeholders and decision makers share a common knowledge and understanding of the issues of concern and the scientific data to support or refute these concerns. To fulfill

this requirement, this workshop was designed to bring a diverse group of decision-makers together to learn about sea level rise, to determine areas that may be potentially vulnerable to its impacts, and to characterize these identified impacts. Scientists, technical experts, state, local and county government officials, not-for-profit organizations, business representatives, academia and others were invited to attend. Please see Appendix A for a list of workshop attendees and the workshop agenda.

The approach taken at this workshop used a structured process to capture information on potential issues and risks faced in certain areas, organizations that should be involved and additional knowledge needed to further characterize the issues identified throughout the workshop. This provided food for thought as it stimulated critical thinking about the details needed to fully evaluate each issue or problem identified.

During a morning plenary, workshop participants heard presentations about sea level rise and sea level rise adaptation from national experts and local project managers:

- *Sea Level Rise and Storm Effects on Coasts*, by S. Jeffress Williams, Senior Coastal Marine Geologist of the U.S. Geological Survey and Woods Hole Science Center;

- *Sea Level Rise Adaptation in Mid-Atlantic States, by* Jim Titus of the U.S. Environmental Protection Agency;

- *National and Regional Planning for Sea Level Rise*, by Kristen Fletcher, Executive Director of the Coastal States Organization; and

- *Developing a Sea Level Rise Strategy for Delaware*, by Susan Love, Planner IV with the Delaware Coastal Programs (Department of Natural Resources and Environmental Control) and Steve Borleske, Director of the Delaware EPSCoR.

These presentations can be found online: http://www.swc.dnrec.delaware.gov/coastal/Pages/SeaLevelRiseAdaptation.aspx

Participants were pre-assigned to break-out groups based on their area of expertise or their prioritized type of concern. The breakout groups were: Economy and Community; Habitat and Natural Resources; Human Health and Public Welfare; and Infrastructure. In each group, facilitators lead discussions on the ideas and concerns pertinent to participants regarding sea level rise. Participants in each group were asked to consolidate and group the ideas and concerns identified in the group discussion into specific issues or categories of issues. These issues were then described in greater detail using the Issue Identification and Characterization Form (see Appendices B through E). The form covered the geographic extent to which these issues pose threat; stakeholder groups that these issues may affect; who should be involved in developing action plans to deal with these issues; and what information may be needed to further address these issues. Lastly, participants were asked to place a measure of priority (high, medium, low) on each issue, while considering the feasibility and perceived economic, social, and environmental benefits and costs of proactively addressing these issues.

The workshop ended with a plenary review of the issues identified and their priorities. Any themes that may have been recognized and data resources or needs observed were also discussed. Finally, participants were encouraged to become involved in future strategy development activities.

Workshop Results

The participants at the workshop identified and provided an initial characterization of 61 sea level rise related issues, 9 of which were categorized as "Economic/Community" issues, 13 as "Habitat and Natural Resources" issues, 20 as "Human Health and Public Welfare" issues, and 19 as "Infrastructure" related issues. Issue Characterizations developed by participants can be found in Appendices B – E.

One of the primary concerns raised was the lack of a diverse representation. Some breakout groups were well attended by a specific group of stakeholders while other key stakeholders were absent. This may have limited the scope of issues considered.

Issues that appeared in more than one breakout group indicate the cross-cutting nature of the potential problems we are facing. These included topics such as the need for more education on the issue, as well as the need for better data and political will. The details of these breakout group proceedings are included in the following sections of this document.

Session Summaries

Participants were divided into four groups based upon their area of expertise to discuss and characterize the potential impacts of sea level rise and potential impacts to Delaware's economy, environment, and quality of life. Because of the cross-cutting nature of most issues related to sea level rise, several groups discussed similar issues, but from different viewpoints.

Each break-out session was led by a facilitator responsible for guiding the discussion; a co-facilitator responsible for capturing participants input; and a note-taker responsible for recording a transcript of the discussion. Before discussions began, ground rules were established and participants introduced themselves, including name, organization, and specific interest or outstanding concern regarding sea level rise.

Each group breakout began by "brainstorming" ideas and concerns pertinent to sea level rise. These ideas were captured by the co-facilitator on flip-chart paper and posted on the wall. As expected, many ideas were duplicative or of similar theme. When the brainstorming session ended, facilitators and note-takers reviewed the ideas captured on the flip charts and grouped similar items into specific issues or categories of issues (if necessary). Participants were then assigned, either singly or in small groups, to complete Issue Characterization Worksheets for each issue of category of issues. Full text of the brainstorming session can be found in Appendix F.

Economy and Community Session Summary

The Economy and Community break out session closely followed the process above. There were 15 participants in this session representing local governments and county governments, State government, University researchers, and non-profit organizations.

The majority of ideas brainstormed by participants fit into the following nine categories:

1. *Maintaining & Growing Delaware Tourism*
   How do we maintain and grow Delaware's tourism industry and what is the magnitude of potential revenue loss if

coastal areas are no longer a target destination?

2. *Personal Responsibility vs. Regulation*
   What level of government involvement is appropriate in "protecting citizens" from SLR and to what extent should citizens assume personal risk for living in coastal areas?

3. *Classifying Coastal Areas: Different Situations, Different Solutions*
   There is no "one size fits all" strategy to adapt to SLR - each geographic segment of Delaware must have different strategy to adapt.

4. *Social Justice*
   How will the State assist vulnerable (elderly, disabled, low income) populations?

5. *Identifying Key Stakeholders & Getting Them To Work Together*
   How do we ensure adequate representation for all interest groups/agencies/population segments and coordinate efforts?

6. *Safety Concerns & Evacuation*
   What are the public health risks and how do we improve evacuation strategies?

7. *Understanding & Managing Risk*
   How do we identify and calculate the impact of data uncertainties?

8. *Water Quality & Economic Impact*
   What are the economic ramifications of impaired water quality to commercial fisheries, drinking water supplies, and wetland loss?

9. *Education & Outreach As A Crosscut*
   How do we disseminate key information to ensure the public is aware of SLR impacts and importance?

Participants were assigned to each of the nine categories (based on area of expertise) and tasked with completing the Issue Characterization Worksheet. Worksheets were completed in the afternoon session and briefly discussed with the group upon completion. Of the nine categories, eight characterization worksheets were completed. One issue, Safety Concerns and Evacuation, was not addressed as participants assigned to that category did not attend the afternoon session; however, safety and evacuation issues were discussed at length within the Public Health and Welfare breakout session.

There was a consensus within the group that multiple key stakeholders were absent which resulted in a narrowly focused discussion. Because this breakout session was well attended by municipal officials from coastal resort towns, a significant portion of the brainstorming session centered on Atlantic coastal resort communities and the role of the National Flood Insurance Program in encouraging residential homes in vulnerable high hazard areas. The group dynamic and discussion may have been broader had there been more representation from urban coastal areas, minority and low-income population advocates, and agricultural and industrial interests.

Another key issue the group identified was the high variability of predicted sea level rise scenarios and challenges associated with preparing an adaptation strategy for such a wide range of possible outcomes. There was a general feeling that planning for the "worst case scenario" may be exorbitantly expensive and unnecessary. However, the group conceded the difficultly of achieving a relative consensus on what level of sea level rise the State should target the adaptation strategy.

Habitat and Natural Resources Session Summary

The Habitat and Natural Resources break out session closely followed the process outlined

above. There were 21 participants in this breakout session representing town governments, county governments, State and Federal land and resource managers and not for profit organizations.

Twenty issues were identified; these were further combined into the following 13 categories.

1. *Wetland Impacts*
   How will we adapt and/or mitigate for wetland loss, wetland degradation, and wetland migration as sea level rises? What are alterations or losses in wetland functions and values?

2. *Critical Habitat/Species*
   How will loss and alteration of habitat affect species (especially endangered and or threatened species)? We need to complete risk assessments in order to adequately evaluate species vulnerability. We need to be aware of species migration shifts and shifts in species ranges as climate changes. There is also a concern regarding species interactions and timing of those (horseshoe crabs/shorebirds). As climate changes and sea level rises, will the interaction between horseshoe crabs and shorebirds (for example) be significantly impacted?

3. *Saltwater Intrusion/Water Quality/Groundwater*
   How will saltwater intrusion impact drinking water wells, agricultural practices, and public health?

4. *Waterfowl Management/Impoundments*
   Do we maintain existing freshwater impoundments or do we allow natural changes to occur? What are the thresholds for retreat? Where will the migratory waterfowl go? How will this impact Delaware's hunting/recreation?

5. *Beach Management*
   How will the loss of beaches impact beach and interdunal species as well as those species who utilize the beach (horseshoe crabs/shorebirds)? How would the loss of beaches impact the littoral conveyor belt? How will the economy be impacted by loss of beaches for tourism and recreation?

6. *Salinity Changes in Surface Water*
   How will salinity changes affect fisheries and oyster habitat? What are the likely changes?

7. *Agriculture*
   How do we maintain or adapt our agricultural practices to address sea level rise (salt tolerant crops, run-off, and irrigation issues)? This could also impact the agricultural economy.

8. *Political Barriers*
   How do we address the lack of political will? Who pays for implementing solutions?

9. *Economic Benefits and Losses*
   Loss of habitat will affect the economy, specifically tourism associated with hunting, fishing, etc. Who will eventually pay?

10. *Education and Outreach*
    How do we engage the general public as well as coastal decision makers? It is important to tailor the information dissemination to the audience.

11. *Scientific Data Needs*
    There is a suite of global, national, and local knowledge. What data do we need to support or refute the national consensus?

12. *Benthic Habitats*
    There could possibly be positive implications with increasing the amount of benthic habitat. Will there be species shifts or loss in the benthic community as

well? We are still in the process of understanding what currently exists in our benthic communities.

13. *Human Responses to Natural Environment* How do we address the conflicts between human needs and natural processes and dynamics? Do you protect or remove human structures? How do you protect shorelines from erosion?

Participants were assigned to each of the original twenty categories based on area of expertise and tasked with completing the Issue Characterization Worksheet. Worksheets were completed in the afternoon session and briefly discussed with the group upon completion. Characterization worksheets were completed for all of the original 20 categories.

A significant portion of the brainstorming session was focused on the broad topics and adaptation planning process questions. The group began to identify more specific issues towards the end of the brainstorming session. It was pointed out that we need to know which scenario of sea level rise we are planning to address. Members of the group also noted that risk assessments need to be conducted to adequately identify more specific issues (especially as it relates to critical habitats and species). The group also understood that additional issues may be identified by technical working groups.

Human Health and Public Welfare Session Summary

The Human Health and Public Welfare break out session closely followed the process above, with minor modifications due to the number of issues discussed. There were 19 participants in this session representing State and Federal environmental and planning agencies, not for profit organizations and University researchers.

Over 60 different issues were identified by participants during a round-robin brainstorming session. Issues were grouped under the following four categories: Saltwater Intrusion & Contamination; Inundation & Shoreline Erosion; Elevated Water Tables; and General Concerns. Due to the number of issues identified, participants prioritized the issues identified in the morning session through "sticky-dot voting." Each break-out group participant received 5 dots that they placed on the issues they felt most important. Twenty issues received votes. Participants were assigned to small groups and tasked with completing the Issue Characterization Worksheet for the highest priority issues. Of the twenty issues prioritized, twelve characterization worksheets were completed.

Prioritized Issues

1. *Waste water systems disposal* Septic systems and sewers could fail with elevated water tables; spray irrigation would not be feasible.

2. *Educating Public and Homeowners* Education on where to go and what to do – identifying shelters, dissemination of information. Educating public on what they can do ahead of time to help themselves – mitigation measures.

3. *Drinking water, wells and water systems* The location of the water supply intakes could be affected by saltwater intrusion. How to ensure potable drinking water? Effect of people who have wells that won't be good anymore and they will lose the value of their land – loss of real-estate value, subsidy issue.

4. *Financing Public Works (cooling intakes, roads, buildings…)*

How would we fund public works projects that would need to take place? Would federal funding pay for support or relocation of public infrastructure?

5. *Agriculture and Food Production*
   How do we maintain or adapt our agricultural practices to address sea level rise (salt tolerant crops, run-off, and irrigation issues)? This could also impact the agricultural economy and the ability to grow food for ourselves and feed for livestock.

6. *Land Use Planning*
   Where are populations concentrating? Where are community service facilities being sited? Long-term planning for public transportation and placement of electrical transmission lines is needed. Building practices may require modification (slabs, crawl spaces, insurance).

7. *Stormwater*
   Will stormwater management facilities continue to be adequate? Stormwater and combined sewer outfalls may need upgrades. Potential for increased flooding during storm events.

8. *Biodiversity Impacts & Ecosystem Modification*
   Ecosystem modifications including loss of habitat, domino effect and systemic change in the environment will cause many yet to be identified issues.

9. *Water Borne Diseases*
   There could be a possible increase in water borne diseases including diseases arising from improperly controlled/treated sewage.

10. *Emergency Evacuation Response (Flooding)*
    What are the specialized equipment and training needs for responders? Are emergency facilities in a flood prone area? Educating populations about where to go and what to do in emergencies is very important.

11. *Location of Community Services*
    How will the location and access to community services be affected by the reduction in usable land for the facilities?

12. *Access to Medical Facilities*
    How can we ensure access to medical care? What are potential impacts to the facilities? Are the roads to them accessible in storms?

13. *Willingness of people to leave*
    Is the population willing to evacuate during flooding events, or relocate after storm damage?

14. *Drainage Issues*
    What areas could be prone to flooding under sea level rise scenarios? How will sea level rise and increased flooding impact business operations, farming and the economy?

15. *Landfill/Contaminated Lands*
    How will the migration of toxic sediments from brownfields, liner failures, dredge spoil sites, underground storage tanks, cemeteries, coal ash, and jet fuel at airports be affected as these areas are inundated or have elevated water tables?

16. *Social Justice*
    Can vulnerable and low income communities evacuate or relocate? What about the housing needs, health programs, emergency services and health in general of low income or elderly populations?

17. *Impact/Damage Private Property*
    What would be the damage to the homes and social impacts to the owners? Concern for the availability of insurance – coastal insurance is difficult to get and is still expensive even with subsidized.

18. *Recreation Infrastructure (mental health)*
    What are the potential impacts to recreation infrastructure? Limited access to recreation activities could impact quality of life and mental health of citizens.

19. *Impacts to Aquifers*
    Where could impacts to aquifers occur? Can populations afford to adapt? Will there be options for clean drinking and irrigation water?

20. *Drinking water for wildlife*
    What potential conflicts will arise between human and wildlife populations as drinking water for wildlife becomes contaminated?

During this breakout group sessions, much discussion focused on existing storm response and storm preparation and the difficulty of separating issues of sea level rise from issues of storm preparedness. Participants were encouraged to discuss any aspect of storm preparedness and response if it was felt that rising sea levels could impact how response could occur or future planning.

Infrastructure Session Summary

The Infrastructure break out session closely followed the process above, with minor modifications due to the number of issues discussed. There were 25 participants in this session representing Federal, State, county and local government entities responsible for research, planning and maintenance of waterways, water supply and transportation.

Approximately 50 specific issues or questions were brought up during the brainstorming session in four categories: Saltwater Intrusion & Contamination; Inundation & Shoreline Erosion; Elevated Water Tables; and General Concerns. There was some overlap between issues discussed in each category. The concerns were grouped into the following 19 categories:

1. *Built features*
   Roads, pipelines, sewer, drinking water, firehouses, waste water treatment facilities (e.g., in Wilmington, which is surround by dykes), landfills, power infrastructure, flood mitigation structures (e.g. tide gates), rails, trail, airports, seaports, all weather stations (ex. stream and tide gauges) at risk.

2. *Land Development Patterns*
   Roads running parallel vs. perpendicular to ocean, maintaining beaches.

3. *Domino effects*
   Connectivity of issues – how one issue affects another.

4. *Coastal Evacuation*
   Access to location and people; ability to provide services; evacuation for emergencies.

5. *Salt water contamination of drinking water*
   How will saltwater intrusion impact drinking water wells, agricultural practices, and public health?

6. *Segmented planning*
   More integrated planning for multiple types of infrastructure.

7. *Shore dependent uses*
   Impacts to Port of Wilmington and industries, leading to large economic consequences.

8. *Agricultural irrigation*

9. *What policies will be used*
   Need to decide on what policies/approaches we will use (retreat, dyke, elevate).

10. *Buried infrastructure*
    Impacts, including corrosion of drainage and drinking water lines; gas lines; sewer lines.

11. *Water related infrastructure*
    Bridges; seaports; storm water infrastructure not designed to handle increased storm intensity.

12. *Changing boundaries*
    Changes to flood plain boundaries, development area boundaries

13. *Transportation infrastructure*
    Bridges (e.g., weakening and wash outs); roads; rails; trails; airports; seaports.

14. *Drinking water*
    Will quality/quantity of drinking water be compromised?

15. *Access to locations and people*
    Evacuation not only affects the people being evacuated but also the locations and residents to which they are being evacuated.

16. *Power infrastructure*

17. *Political will*

18. *Natural Features*
    Changes to these features (beaches, wetlands, others) may impact built features.
19. *Increased stress on existing infrastructure*

Participants were asked to place their initials next to the issue upon which they placed most priority; this served to provide focus for assigning groups to fill out Issue Characterization Forms. Participants were then grouped according to their top prioritized issue and filled out Issue Characterization Worksheets. Upon completion, there was brief discussion of the information written on each form as each group was allowed the chance to report out. A total of 9 forms were filled out for this group.

During discussions, participants felt that there was a need for "critical infrastructure" to be defined, while the question was raised whether or not there is need for distinction between and separation of private vs. public infrastructure issues. Also a part of the general consensus was the need to firmly decide on what policies or approaches will be used by the state (retreat, dykes, elevate) and federal government. Another hot topic was the issue of costs/budgets. Participants agreed that changing the infrastructure is expensive and that there is a need for benefit costs analyses for improvements for infrastructure.

Common Concerns and Comments

A common comment amongst attendees was that several key stakeholders were not at the workshop that would have important input and would be beneficial to the program. Participants agreed on the need for terminologies to be defined (e.g., "critical infrastructure"), as well as the sea level rise scenarios and scientific data that will be used as focus for the adaptation planning, since there is currently a vast range of scenarios being discussed. The need for political will and firm decisions on what policies or strategies will be used by the state (retreat, dykes, elevate) was a general consensus.

Costs or budgets were a common concern amongst groups recognizing that change may be expensive and benefit cost analyses for

improvements and adaptation strategies should be considered. A significant portion of attendees felt it was difficult to separate sea level rise issues from issues of storm preparedness, and to distinguish between private vs. public infrastructure issues. Many participants also noted that risk assessments need to be conducted to efficiently identify more specific sea level rise issues; long or short term planning needed to be decided upon; environmental justice needed to be addressed and saltwater intrusion and its impacts on water quality should be a major concern.

Next Steps

Over the next several months, the Delaware Coastal Programs, with the assistance of research, technical and political experts will use the results of this workshop to form the basis for determining data gaps, issues and strategies for management and adapting to sea level rise. A coordination committee and technical working groups will be tasked with the evaluation and refinement of issues identified to date, as well as identification of other issues relevant to sea level rise that were not identified at this initial workshop.

In addition, a broader range of stakeholders will be identified and a public outreach plan will be developed to ensure participation from a wide audience.